

# A review of mitigation of greenhouse gas emissions in the NSW coal mining sector

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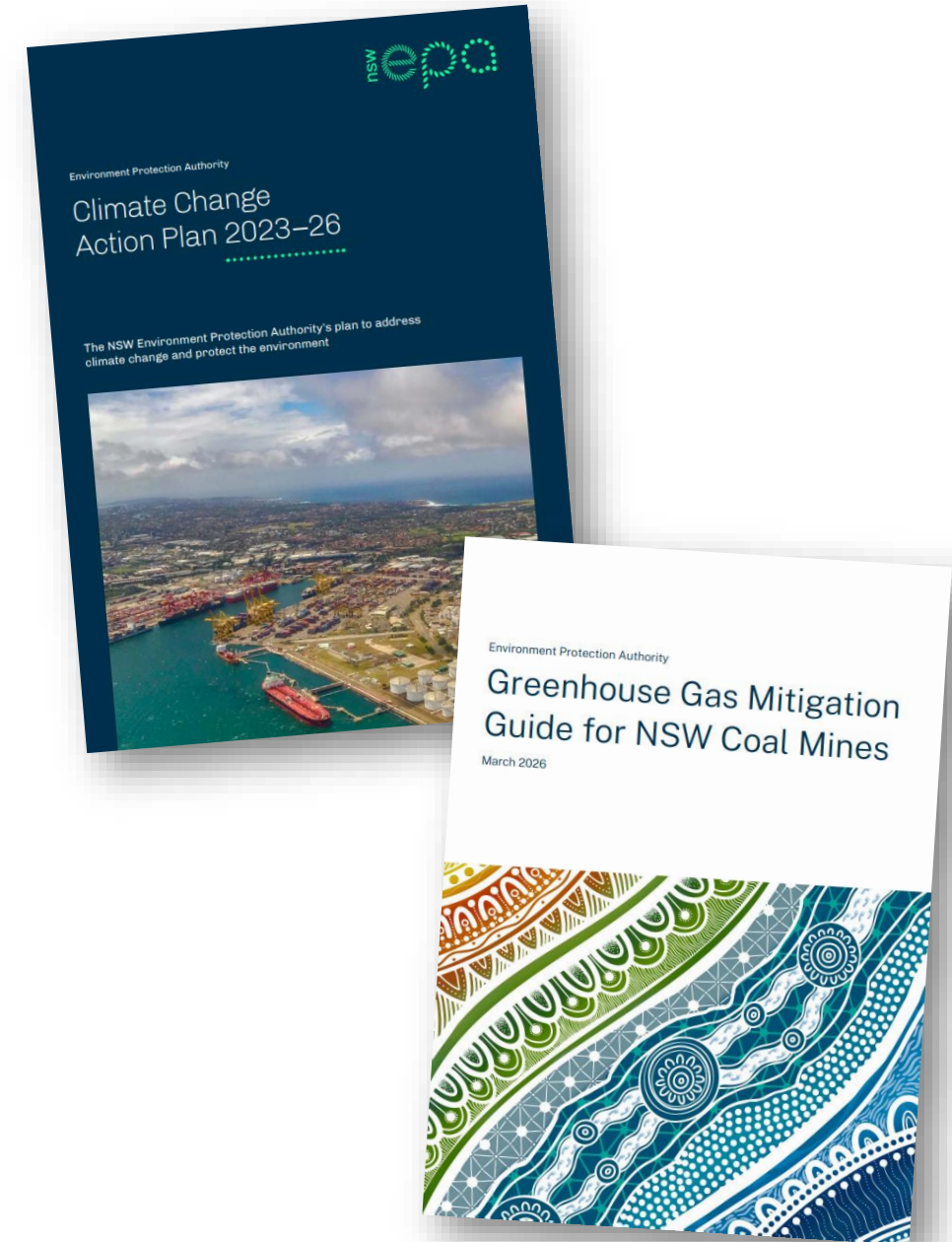


# BACKGROUND

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- In 2023 the NSW EPA published its *Climate Change Policy and its Climate Change Action Plan 2023–26*.
  - The EPA is producing guidance documents for key industries to reduce GHG emissions. The first was released in March 2026 - *Greenhouse Gas Mitigation Guide for NSW Coal Mines*.
- The Mitigation Guide aims to help proponents of new coal mining projects to prepare GHG assessments, and licensees of existing coal mines to prepare Climate Change Mitigation and Adaptation Plans.

A literature review and industry scan were undertaken to provide technical information to support the Mitigation Guide (EMM 2025).



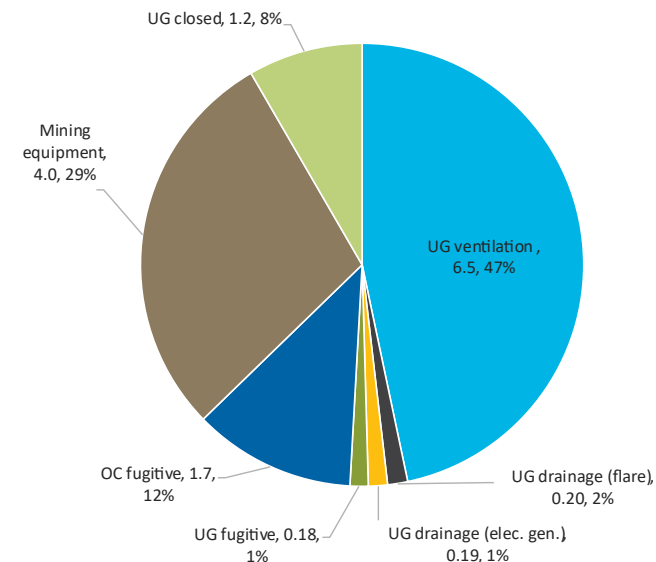
## Background

- In FY 2021-2022, the NSW coal mining sector was responsible for 13.9 Mt CO<sub>2</sub>-e of direct (scope 1) emissions, or 12% of state-wide GHG emissions.
- Fugitive emissions (~60%), and fuel combustion emissions associated with mining machinery (~30%), for active mines accounted for almost all emissions. Emissions from closed mines were ~8%.

*GHG emissions from the NSW mining sector in 2021-22 (active mines)*

| Source                                                  | GHG emissions (Mt CO <sub>2</sub> -e/year) |
|---------------------------------------------------------|--------------------------------------------|
| Fugitive emissions from coal mining                     | 10.0 (72.7%)                               |
| Fuel combustion in mining                               | 3.7 (26.7%)                                |
| Fugitive emissions and fuel combustion from oil and gas | 0.1 (0.6%)                                 |
| <b>Total</b>                                            | <b>13.8</b>                                |

*Emissions from coal mining in NSW by source in 2021-2022 (scope 1, Mt CO<sub>2</sub>-e/y)*



# **STUDY APPROACH**

# Study approach – literature review

- International guidance and measures relating to the mitigation of GHG emissions from coal mines.
- Online searches of govt. policies, technical publications, news items and international scientific publications, followed by filtering, summarising each significant document, and rating significant documents in terms of relevance to the study.
- Resulted in 50 separate shortlisted documents.



## Study approach – industry scan

- In 2024-2025 the EPA and EMM conducted a consultation with the NSW coal mining industry – the ‘**industry scan**’.
- Online interviews were conducted with coal mining companies, the peak industry body, and several experts. Participants also completed a survey off-line. Interviews with nine mining companies were conducted.
- The purpose was to understand what the coal sector is currently doing to mitigate GHG emissions, to identify the most important factors that influence mine operator decision-making, and to identify potential case studies.
- The study placed emphasis on existing and emerging mitigation measures and a focus on measures to address fugitive methane and diesel use.

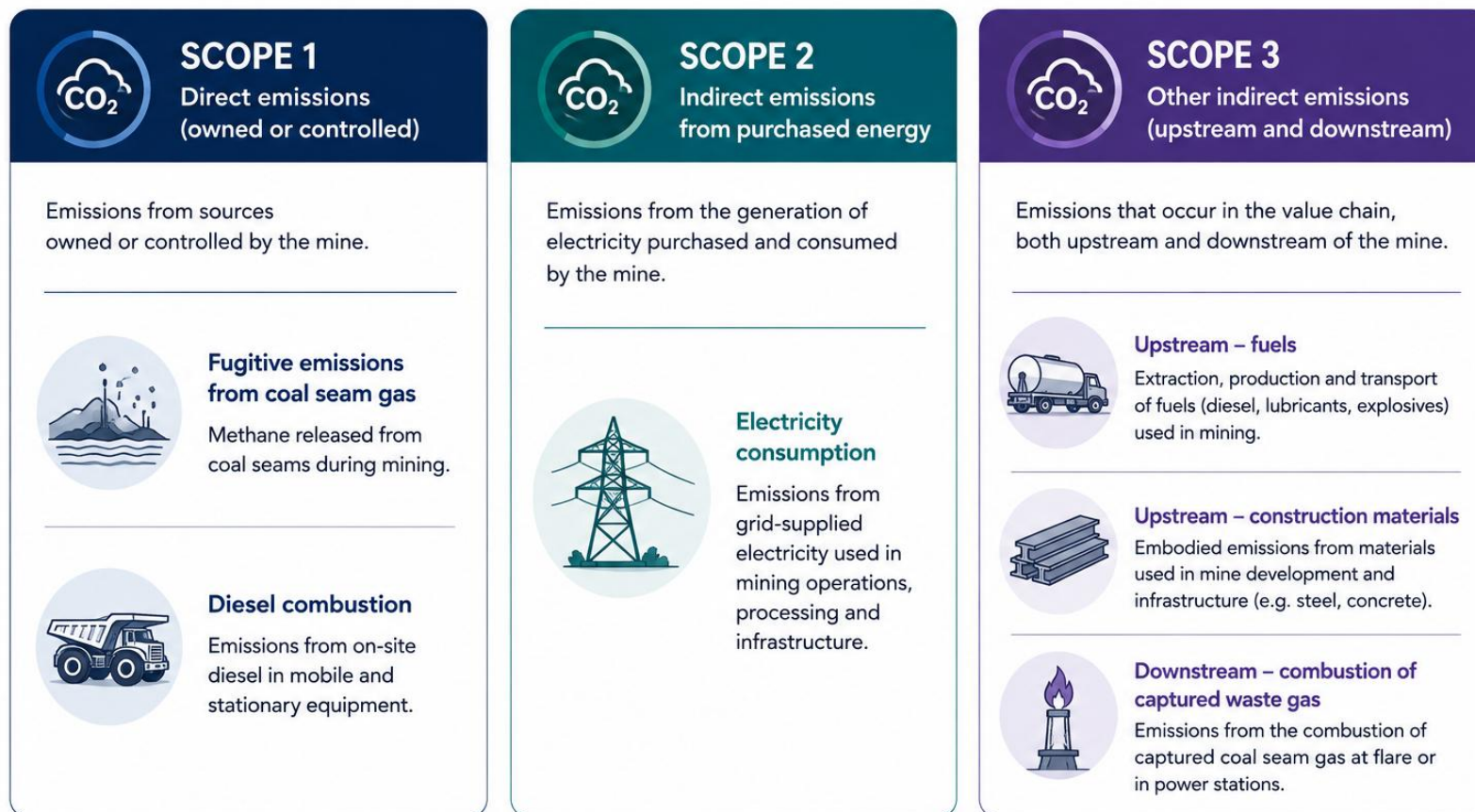


# LITERATURE REVIEW

# Literature review – main sources of GHG emissions

## GREENHOUSE GAS EMISSIONS FROM NSW COAL MINES

*Emissions sources by GHG Protocol scope*



\* Most significant emission sources

# Literature review – fugitive methane (Scope 1)

Gassy underground coal mines present the largest potential for mitigation, as they account for the largest share of emissions from the coal mining industry.

## Existing measures

- Active UG mines: Pre and post gas drainage, flaring, regenerative thermal oxidation (RTO).
- Closed UG mines: Mine flooding and sealing.

## Emerging measures

- Active UG mines: Regenerative catalytic oxidation (RCO), methane enrichment.
- Few emerging measures for active surface mines and closed UG mines.



Source: Photograph courtesy of CSIRO

**Trial of CSIRO's VAMMIT technology at Appin Coal Mine**

# Literature review – diesel combustion (Scope 1)

## Existing measures

- Mine planning and operation.
- Fleet planning and procurement of energy-efficient vehicles.
- Servicing and maintenance.
- Driver training.
- Biodiesel and fuel additives.

## Emerging measures

- Electrification (haul trucks).
- Renewable diesel, methanol and hydrogen.

### BHP launches renewable diesel trial, raising concerns over biofuel in net zero transition

Posted 14 Mar 2023 at 5:46am, updated 14 Mar 2023 at 6:02pm



BHP haul trucks are trialling renewable diesel to reduce carbon emissions on site. (Supplied: BHP)

## Literature review – electricity (Scope 2)

### Existing measures

- Energy efficiency (variable speed drives, high efficiency fans and pumps etc.).
- Renewable grid electricity (PPAs and LGCs).

### Emerging measures

- On-site renewable energy generation.
- On-site energy storage (batteries).

The decarbonisation of the NSW grid will reduce scope 2 emissions from coal mines substantially.



Source: Photograph by CS Foto

**Wind turbines, solar farm and batteries at EDL's Agnew Hybrid Renewable Microgrid site supporting the Agnew Gold Mine (WA)**

## Literature review – gas drainage utilisation

Fugitive methane measures oxidise  $\text{CH}_4$  to  $\text{CO}_2$  but do not eliminate emissions. Various options are available for utilising methane captured from active and closed underground mines. Emissions are effectively converted from scope 1 to scope 3 during utilisation.

- Injection into natural gas pipelines.
- Manufacture of chemical feedstock.
- Production of compressed natural gas (CNG) and liquified natural gas (LNG) fuels for road vehicles.
- Hydrogen production (e.g. pyrolysis).
- Power generation for mine use or export to the grid.
- Town or industrial gas use.
- Mine site (heating, cooking, boilers, residences).

# INDUSTRY SCAN

## Industry scan — general interviewee comments

- The Mitigation Guide should reflect a collation of industry practices and should not seek to dictate what represents 'best practice' or what may or may not be suitable for individual mining operations.
- Coal mines have a wide range of methane emissions intensity. There is no 'one size fits all' approach for mitigation.
- The requirements of the Mitigation Guide should strike a balance with the requirements of the Safeguard Mechanism and NGERs.
- Where mines have relatively short remaining life, emission-reduction initiatives that require significant capital will be challenging to justify.



# Industry scan – mitigation

## Scope 1

- Fugitive methane:
  - Main existing measures are pre and post gas drainage with flaring, and some power generation.
  - Several mines are considering RTO or considered it to be unfeasible due to low methane concentrations in ventilation air, safety concerns and, from an economic perspective, a short remaining life of mine.
- Diesel:
  - Electric equipment is common. Some large equipment at surface mines is already electrified, such as draglines and shovels, but the electrification of haul trucks is an emerging technology.
  - Biodiesel and renewable diesel have not been widely implemented due to high cost compared with conventional diesel, limited supply, and the lack of detailed studies of their effects.

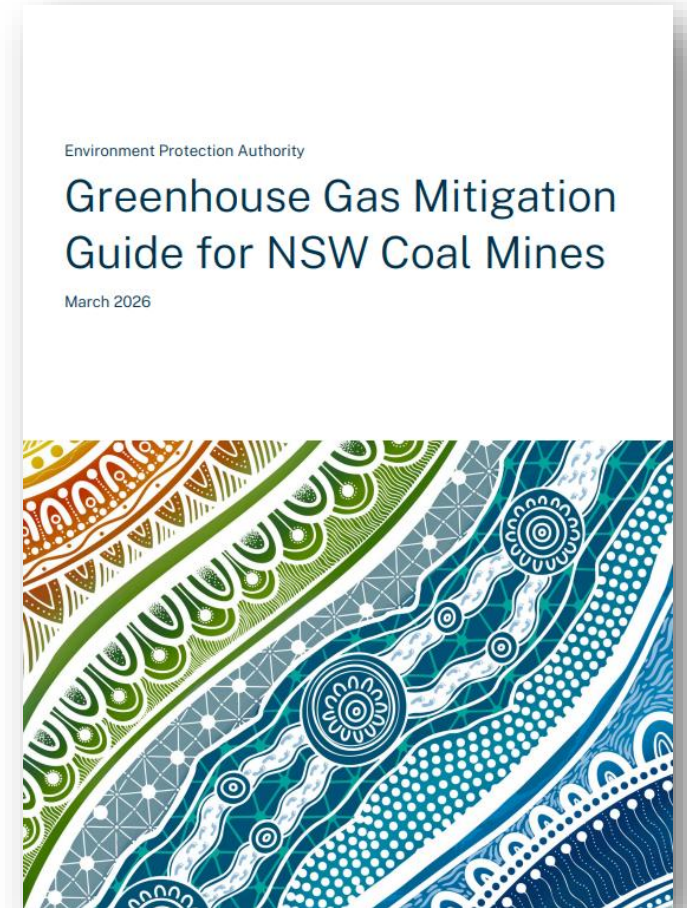
## Scope 2

- Variable speed motors implemented where possible.
- PPAs are considered however a short remaining mine life is a barrier.
- On-site renewable energy has been implemented but barriers include low cost-effectiveness and space.

# **APPLICATION IN THE EPA MITIGATION GUIDE**

# EPA Mitigation Guide

- The Mitigation Guide established clear requirements (under certain conditions) and implementation timeframes for proponents including:
  - Flaring of drainage gas under specific conditions by 1 July 2027.
  - Detecting and managing leaks from old mine workings by 1 July 2027.
  - VAM abatement at operational underground mines by 1 July 2030 for mines emitting over 1 Mt CO<sub>2</sub>-e/year.
  - Outcome-based alternatives to gas drainage and VAM abatement - mines must show that abatement alternatives achieve the same level of emissions reduction at their own mine or at another in NSW.
- The Mitigation Guide recommends:
  - Reducing diesel emissions with lower carbon fuels and low-emission vehicles.
  - Commitments to reducing emissions for proposals seeking modifications or extensions.
  - Supporting the NSW legislated emission reduction targets.





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